

**On-Line Electrochemical Sensors for  
Monitoring Time-Dependent Water-polymer  
Interactions in Industrial Lubricants**

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**ABSTRACT**

A few hundred ppm of water can cause detrimental changes in the lubricating properties of engine oil. On-line sensors based on electrochemical impedance spectroscopy and cyclic voltammetry were utilized to detect water leaks and continuously monitor the time dependent dynamics of water-oil interactions. Immediately following injection a significant amount of water would interact with the oil additives forming inverse micelles. The on-line data was used to characterize the processes of water micellization, evaporation and electrolysis. The values of kinetic rate constants and diffusion coefficients for the components of the water-oil system were determined. In order to support the experimental data and establish the kinetics of water-oil interactions, literature equations describing the interactions were adopted to develop a computational analysis model. The model illustrates what is occurring in the oil at any given time and results in an increased understanding of the recorded experimental data.